

Our Ref: 302287GB/DJW/DG/ab

6 August 2003

Your Ref: A717:47070-ENG

Subsonic 9-6-21-24 + 8



Attn: Patricia Lott - Docket Administrator, Room 4U-533C
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Dear Sirs,

UK Patent Application No. 0228196.2
**SPLIT BARRIER LAYER INCLUDING NITROGET-CONTAINING
PORTION AND OXYGEN-CONTAINING PORTION**

We enclose the official search report which has now issued on this application, together with a copy of the documents cited therein. As you will see, the Search Examiner considers the above application to relate to five different inventions and has therefore based his search in respect of the first invention only. Please let us know if you would like us to file requests for searches in respect of the other four inventions.

No other action is required in response to the search report, but you may submit amendments to the specification and/or claims if you consider it advisable to do so before the application is published or examined. A further opportunity for amendment will arise during substantive examination.

The application will be published at some date after **19 August 2003**. The request for substantive examination will have to be filed within six months of the publication date. Examination will be based on the search report and any amendments filed before the Examiner makes his report. We will let you know as soon as we are informed of the precise publication date and hence of the period allowed for requesting substantive examination.

Yours sincerely

David J. Williams
PAGE WHITE & FARRER

Enc.

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Application No: GB 0228196.2
Claims searched: 1 to 5

Examiner: Anna Brandon
Date of search: 21 July 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1, 3	US5494859 A	(LSI LOGIC) A doc figs 2-5; col 4 line 58-col 5 line 12, col 5 line 56, col 6 lines 9-19
X	1, 3	US6037664 A	(HORWATH) figs 15, 16, col 4 lines 37-67, col 5 lines 16-26, col 7 lines 1-2
E, X	1	GB2365215 A	(IBM) fig 1, p4 lines 13-15, p5 lines 19-31
A		GB2341484 A	(UNITED MICROELECTRONICS) fig 4d
A		GB2367426 A	(AGERE SYSTEMS GUARDIAN) figs 3a, 4, 5

Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art.
Y Document indicating lack of inventive step if combined with one or more other documents of same category.	P Document published on or after the declared priority date but before the filing date of this invention.
& Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^V:

H1K

Worldwide search of patent documents classified in the following areas of the IPC⁷:

H01L

The following online and other databases have been used in the preparation of this search report:

Online: EPODOC, WPI, JAPIO



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28 JUL 2003

Ans'd.....

Your Reference: 302287gb/DG/ab
Application No: GB 0228196.2

22 July 2003

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Dear Sirs

Patents Act 1977: Search Report under Section 17(5)

I enclose two copies of my search report and two copies of the citations.

Plurality of invention

I consider that your application relates to more than one invention as follows:

- a) A semiconductor product comprising a barrier between a copper-containing structure and dielectric film; a nitrogen containing oxygen-free first barrier forming a boundary with the copper structure; and an oxygen-containing nitrogen-free film forming a boundary with the low-k film as defined in claim 1;
- b) a semiconductor product comprising a film stack including an etch-stop layer and hardmask layer, both formed from oxygen-doped silicon carbide, as defined in claim 6;
- c) a semiconductor product comprising a copper surface; a nitrogen-containing first barrier layer (which isn't necessarily oxygen-free); an oxygen doped, nitrogen-free second barrier layer; a first low-k dielectric film; a silicon carbide etch-stop layer; a second low-k dielectric film; and an oxygen-doped silicon carbide hardmask, as defined in claim 7;
- d) a process for forming a semiconductor product comprising treating a surface with ammonia-containing chemistry as defined in claim 8; and
- e) a process for forming a semiconductor product comprising treating a copper surface with ammonia plasma; forming a first barrier layer; forming a second barrier layer of oxygen-doped silicon carbide; and forming a porous low-k dielectric film, as defined in claim 11.

Claim 6, which does not include a barrier layer, clearly defines a separate inventive concept



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from the other independent claims. The common subject matter of other independent claims 1, 7, 8 & 11 is anticipated. My search report relates to the first invention only. If you want any of the other inventions searched, you should file a separate Patents Form 9/77 for each invention.

Publication

I estimate that, provided you have met all the formal requirements, preparations for publication of your application will be completed soon after **19 August 2003**. At this time you will receive a letter confirming the exact date when the preparations for publication will be completed. This letter will also tell you the publication number and date of publication of your application.

Withdrawal/amendment

If you wish to withdraw your application before it is published you must do so before the preparations for publication are complete. **WARNING** - after preparations for publication are complete it will NOT be possible to withdraw your application from publication.

If you wish to file amended claims for inclusion with the published application you must do so before the preparations for publication are completed. If you write to the Office less than 3 weeks before 19 August 2003 please mark your letter prominently:

"URGENT - PUBLICATION IMMINENT".

Yours faithfully

A Brandon

Anna Brandon
Examiner